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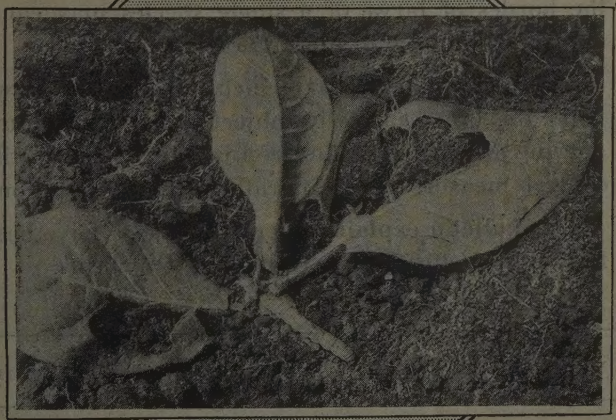
TOBACCO CUTWORMS AND THEIR CONTROL



NO FORM of insect injury is more familiar to growers of plants than that caused by cutworms. The Indians found cutworms troublesome in their fields of corn, and the early colonists acquired certain methods for their control from the aborigines. As the continent has come more and more under the plow, these pests have exacted a heavy toll from American agriculture every year, occasionally occurring in great outbreaks in which the hordes of larvæ of a single species may cause damage running into the millions of dollars.

The conditions under which tobacco is grown make this crop especially subject to cutworm injury, and the acre value of the crop is sufficient to justify control measures even in rather light infestations.

This bulletin explains the methods that have been found most effective for combating cutworms.

Washington, D. C. Issued August, 1926

TOBACCO CUTWORMS AND THEIR CONTROL

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TOBACCO PLANTS are transplanted to the open field in such small numbers per acre that a rather light infestation of cutworms may cause serious loss, and in most sections this liability to damage is increased by the fact that tobacco usually follows sod or weedy land.

LIFE HISTORY OF CUTWORMS

Fields become infested with cutworms through the activities of certain stout, dull-colored moths or "millers" which fly at night. Each female of these moths may lay from a few hundred to as many as 1,500 or more eggs. Most species prefer to lay their eggs in grass sod, clover sod, pastures, or weedy land, but two of the tobacco-infesting species lay their eggs exclusively in cultivated ground. Several kinds of these moths are shown in the accompanying illustrations.

The eggs laid by these moths are about half as broad as a pinhead, and may be deposited in a patch including several hundred (fig. 1), although many species place them singly or only a few together. Usually within a few days after they are laid the eggs hatch, producing very small cutworms. These cutworms eat greedily and may soon reach mature growth. They then disappear in the soil, where a small chamber or cell is hollowed out, in which the larva or cutworm changes to the pupa (fig. 2). The pupa, in turn, is transformed into a moth like the one which laid the egg; and the moth, after emerging from the soil, may lay eggs to produce another generation of cutworms.

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SEASONAL HISTORY

PERIOD OF DESTRUCTIVENESS IN THE SPRING

Whether only one generation or several generations are produced during the year, all of the common species occur as large cutworms during April, May, and June, after which there is a lull in their destructiveness while a new generation is growing up. During this lull, vegetation becomes so abundant and various enemies become so active that cutworms seldom cause serious injury in fields after about the middle of June. In northern Tennessee serious injury rarely occurs after the early part of June.

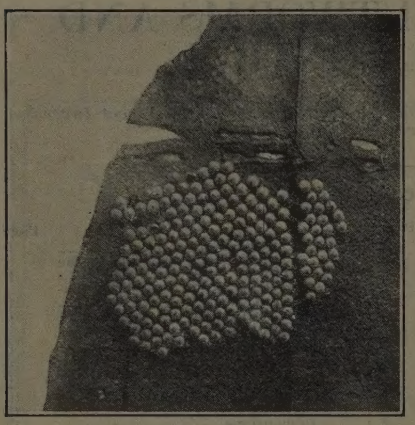

FIG. 1.—Eggs of the variegated cutworm moth

SPECIES WHICH LAY THEIR EGGS IN THE SPRING

Some cutworms pass the winter as pupæ and the moths emerge from the soil and lay their eggs in the spring. No matter how clean the field may have been in the fall, if an attractive growth of vegetation appears in the spring by the time these moths are on the wing, they will infest it with cutworms. These moths begin to fly in small numbers early in February in northern Tennessee, and in the extreme South they may be present throughout the winter. This group includes some of the most destructive species, such as the variegated cutworm and greasy cutworm which are discussed below.

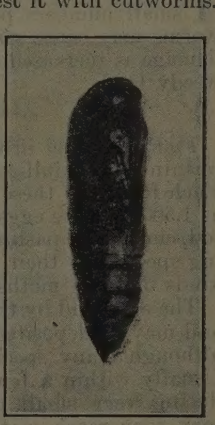

FIG. 2.—Pupa of a cutworm

THE VARIEGATED CUTWORM [1]

The variegated cutworm (fig. 3) occurs in injurious numbers wherever tobacco is grown, and has probably caused as much damage as any other cutworm in the United States. In Tennessee it is one of the common species injurious to tobacco in fields but is especially injurious to plant beds. There are four generations during the year in Tennessee, and the winter is passed as a pupa.

Moths begin to emerge very early in the season and the destructive spring activity of the larva is over in Tennessee by the latter part of May. In Kentucky and Illinois larvæ remain active in destructive numbers until

[1] *Lycophotia margaritosa* Haw., var. *saucia* Hbn.

early in June. The main fall flight of moths occurs in August, September, and October.

This cutworm varies considerably in color but it may always be distinguished by the presence of a row of yellow or orange dots down the middle line of the back, at least on the fore part of the body.

THE GREASY CUTWORM [2]

The greasy cutworm (fig. 4) is injurious throughout the tobacco-growing regions, but is most abundant in the more northern portions of its range. In Tennessee there are four broods during the year, and the winter is passed in the pupa stage.

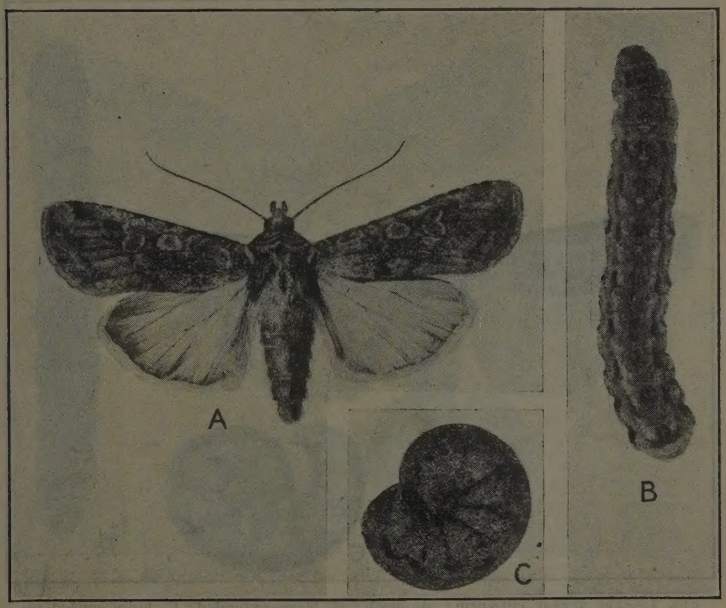

FIG. 3.—The variegated cutworm: A, moth; B, larva, or cutworm, extended; C, larva curled up

In the extreme South, cutworms of this kind may be active throughout the winter, but in northern regions they become destructive early in May, and may occur in injurious numbers until the end of June or even into July. Outbreaks of this species sometimes occur in land which has been covered by water during floods, the moths seeming to be attracted to such places for egg laying.

This is a large dark-colored cutworm, and the skin is shiny and smooth to the touch because of the presence on it of a multitude of very small, shiny granules which, when examined closely with a magnifier, give the larva the appearance of being covered with drops

[2] *Agrotis ypsilon* Rott.

of a very fine mist. Larvæ of this species are very pugnacious and readily eat other larvæ when they are confined together.

SPECIES WHICH LAY THEIR EGGS IN THE FALL

Many species pass the winter as larvæ or cutworms. These species do not produce moths for egg laying in the spring in most cases until the usual period of cutworm destructiveness is past. The moths belonging to this group infest with cutworms only those fields which present a growth of vegetation or other conditions favorable for egg laying in the fall when the moths are in flight. The main period of flight in any particular species extends over a period of only three

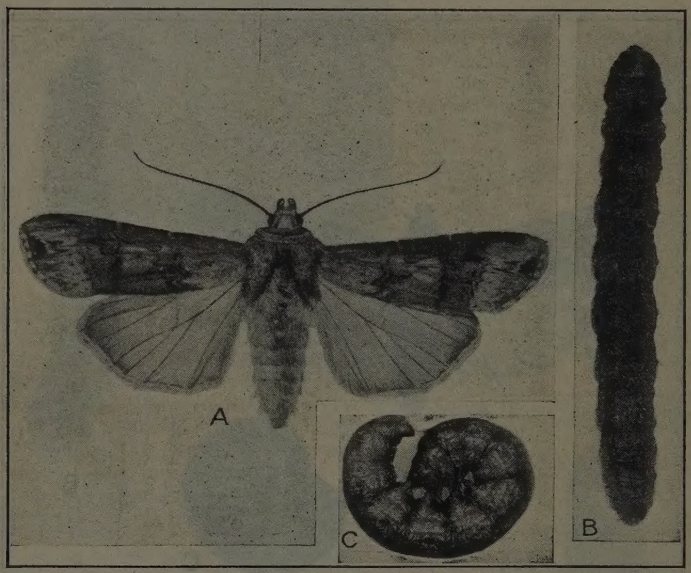

FIG. 4.—The greasy cutworm: A, moth; B, larva extended; C, larva curled up

or four weeks, but all species do not fly at the same time and heavy egg laying may take place in one or another of the species from early in August until late in October. This group includes, among others, the dingy cutworm, the clay-backed cutworm, the dark-sided cutworm, and the spotted cutworm. In the discussion of each species is given the time of the main flight of moths of that species.

THE DINGY CUTWORM[3]

The dingy cutworm (fig. 5) is one of the most common cutworms in Tennessee and Virgina and in the region north of these States, but is scarce or entirely absent in the States to the south. The

[3] *Feltia ducens* Walk.

winter is passed in the larva or cutworm stage, and there is but one generation during the year.

In northern Tennessee most of the cutworms of this species have ceased feeding by the middle of May, but it is the middle of June in Illinois and the last of June in Canada before most of the larvæ in these regions have completed their activity. The main flight of moths takes place in Tennessee between September 10 and October 10, whereas in Illinois, Iowa, New York, and Canada the main flight occurs between August 15 and September 5.

FIG. 5.—The dingy cutworm: A, Moth; B, larva extended; C, larva curled up

THE CLAY-BACKED CUTWORM [4]

The clay-backed cutworm (fig. 6) has been particularly injurious in Illinois and Kentucky and is one of the more common species injurious to tobacco in Tennessee. It is widely distributed but is scarce south of the latitude of Tennessee and Virginia. The winter is passed in the larva or cutworm stage, and there is but one generation during the year.

Most of the larvæ have passed their destructive stage in northern Tennessee by the middle of May, but it is the last of May or early in June before the main activity of the majority of the larvæ is over in Kentucky and Illinois. The main flight of moths occurs in Tennessee between October 1 and 10, and in Kentucky and Illinois the

[4] *Feltia gladiaria* Morr.

greater number of the moths appear during the latter half of September. As with the dingy cutworm, the moths of the clay-backed cutworm emerge later in Tennessee than in States farther north.

THE DARK-SIDED CUTWORM [5]

The dark-sided cutworm (fig. 7) is a northern species which has done great damage to a variety of crops. It occurs sparingly, if at all, south of Tennessee. The winter is passed wholly or in part in the egg stage, and there is but one generation during the year.

Most of the larvæ have completed their activity in Tennessee by

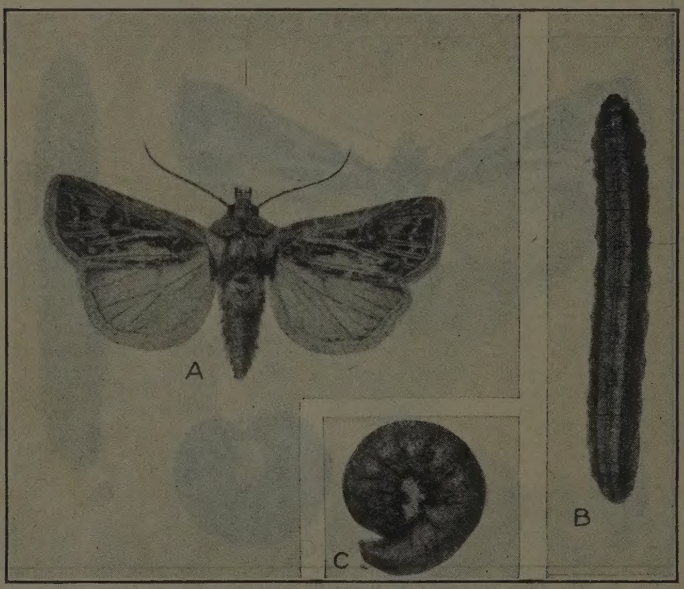

FIG. 6.—The clay-backed cutworm: A, Moth; B, larva extended; C, larva curled up

June 10, and this period of destructive occurrence comes to a close about June 15 in Illinois. The moths emerge during an unusually long period, being found in numbers during July, August, and September. Moths of this species are peculiar in that they lay their eggs exclusively in cultivated fields and the long egg stage allows time for vegetation to develop in such fields before the eggs hatch.

The larva has a prominent white stripe on the side above the legs, and the dark coloring on the head is arranged in freckles instead of being composed of a network of lines, as is the case in all of the other cutworms described here.

[5] *Euxoa messoria* Harr.

THE SPOTTED CUTWORM [6]

The spotted cutworm (fig. 8) is a very destructive northern species, but is scarce in Tennessee and probably does not occur much farther south. The winter is passed as a larva or cutworm, and there are at least three generations during the year in Tennessee.

The period of destructiveness for cutworms of this species is over in Tennessee by the middle of April, but extends somewhat into May in Illinois. The main flight of the moths of the last broods—and it is these which infest land with the injurious spring brood of cutworms—begins early in August and extends at least through September.

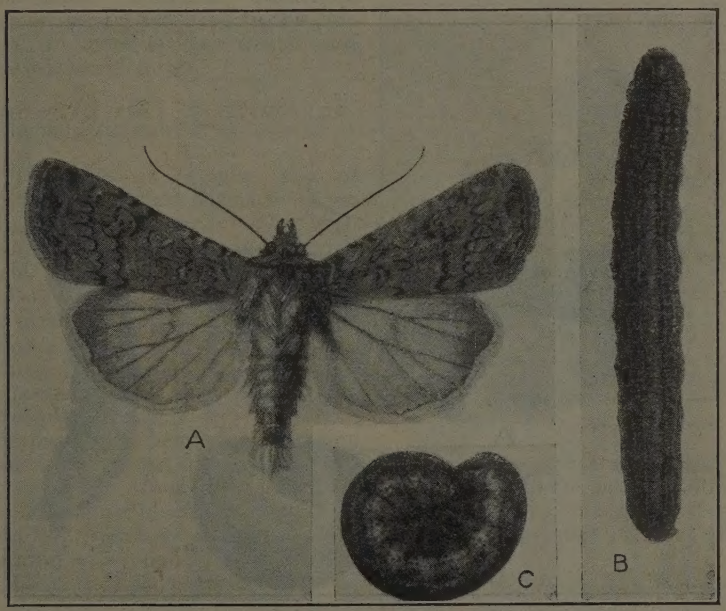

FIG. 7.—The dark-sided cutworm: *A*, Moth; *B*, larva extended; *C*, larva curled up

This cutworm has a row of wedge-shaped black marks down each side of the back and has no black marks on the sides.

NATURAL CONTROL

Under normal conditions cutworms are so perfectly controlled by a silent, unseen, and highly complex set of natural checks that, comparatively speaking, only an occasional straggler survives to injure crops. It is only when this natural balance has been disturbed in some way that cutworm outbreaks occur. Some of the agencies which have a part in this control are mentioned in the following paragraphs.

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[6] *Agrotis c-nigrum* L.

PREDATORY ENEMIES

About 55,000 predatory insects and spiders are present on the average acre of farm land in northern Tennessee in April, counting each of the 3,000 anthills as a unit. Leaving some very small forms out of consideration, there are about 216,000 individuals of other kinds on the average acre at this time which might supply the predators with food. The food species include 9,000 cutworms and the predators include 25,000 spiders (fig. 9) and 20,000 ground beetles and their larvæ (fig. 10) per acre.

Under these conditions it is not hard to imagine what becomes of the cutworms in those grim games of hide-and-seek which go on among the litter and fallen grass of our apparently peaceful fields.

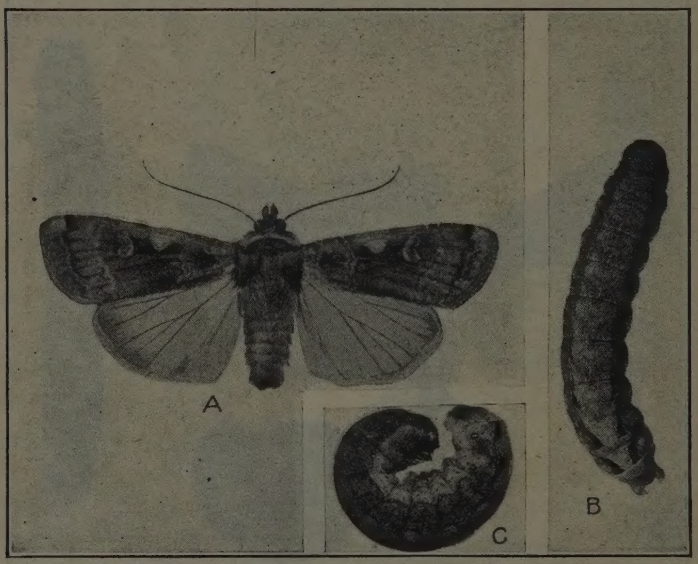

FIG. 8.—The spotted cutworm: *A*, Moth; *B*, larva extended; *C*, larva curled up

Birds play an important part in the control of cutworms. During May cutworms and similar larvæ make up more than 20 per cent of the average diet of such common species as the chipping sparrow, cardinal, meadowlark, robin, redwing blackbird, bluebird, bobolink, Carolina wren, bobwhite, and crow, taking these birds as a group. Toads are also highly beneficial as cutworm destroyers.

INSECT PARASITES AND DISEASE

Cutworms are attacked by a large number of insect parasites and are subject to a surprising number of diseases (fig. 11). The work of these agencies is usually not very evident, but the organisms concerned are capable of reproducing very rapidly under favorable conditions and the suppression of great cutworm outbreaks is probably chiefly due to their intervention.

CLIMATIC CONDITIONS

Very heavy rains late in the fall may cause an unusually heavy mortality in the pupæ of those species which pass the winter in this stage, so that cutworms of these kinds may be scarce the following spring. Excessive washing rains also sometimes kill the active cutworms themselves in large numbers by drowning them or burying them beneath drifting soil. Some cutworm species are not able to withstand much cold, and this is the main factor which limits the distribution of these species to southern latitudes. Very cold weather and particularly abrupt changes from warm to cold and cold to warm have great influence in reducing the numbers of all species of cutworms. Climatic conditions are especially effective in the control of those species which pass the winter as pupæ.

FIG. 9.—Spider feeding upon a cutworm

HOW TO TELL IF CUTWORMS ARE PRESENT IN A FIELD

There is no certain way of distinguishing cutworms from various similar larvæ. But cutworms are able to survive plowed-field conditions better than most other species, and we may take advantage of this fact to determine rather satisfactorily whether injury from this source is to be expected. This may be done in a well-plowed field by scattering compact bunches of vegetation over land several days after plowing and examining the soil beneath them two or three days later. The vegetation should be of a kind, such as clover, dock, or chickweed, upon which cutworms feed readily, and the bunches should be of such size that the portion next the ground will remain green during the test.

If larvæ similar to any of those shown in this bulletin are found under these bunches of vegetation they are very probably cutworms, and their number will indicate whether a poisoned bait should be broadcast over the infested portions of the field, preferably some days before the tobacco is set.

REMEDIAL MEASURES

DRY APPLICATIONS TO PLANTS IN THE FIELD

The use of the poisoned bait described on pages 10 to 11 is advised. But in some tobacco-growing regions it is the custom to dust the plants after setting with a mixture of wheat flour, sifted wood ashes, corn meal, or rice flour, and Paris green. This mixture is made up so as to include from 25 to 60 or more pounds of the diluent to each pound of Paris green, the proportions which may be used depending upon the thickness of the coating which is applied to the

plants. The application is made by means of a tin can with a finely perforated bottom. The can is attached to a wooden handle about 2 feet long, by means of which it is shaken closely above each plant as the operator walks down the row.

This is an effective cutworm remedy in moderate infestations, but may cause the death of many of the plants. There is no accurate way of gauging the quantity applied, and moreover a dosage of the mixture which may have been found safe in preceding years may prove highly injurious in a season in which climatic conditions are not the same. Injury is especially likely to occur in hot, moist weather.

FIG. 10.—Larva of a ground beetle feeding upon a cutworm

MATERIALS TO USE IN A POISONED BAIT

After testing about 50 bait poisons at various dosages against cutworms, and experimenting with various flavorings, including sweetening and citrous fruits, the writer has arrived at the following as the best formula of those tested for a cutworm bait:

Wheat bran	50 pounds
Paris green	1 pound
Water	enough to moisten

In case Paris green can not be obtained, sodium fluoride will give good results at the same dosage. Zinc arsenite and zinc ortho-arsenite are also efficient bait poisons at a slightly heavier dosage. White arsenic, if it can be obtained in a very finely powdered form, will give good results at a dosage of 2 pounds to 50 pounds of bran; but the ordinary granular white arsenic is not at all satisfactory. Lead arsenate and calcium arsenate do not give good results as cutworm poisons.

As a carrier, shorts has been found better than wheat bran in some cases, but the bran will usually be found satisfactory. Alfalfa meal and a mixture of half rice bran and half cottonseed meal have also been used in place of bran. Sawdust or similar materials should not be used as carriers. Such substitutes distinctly reduce the attractiveness of the bait, and the cost of the bran usually amounts to less than one-third of the total expense for materials and application.

HOW TO MIX THE POISONED BAIT

The bran and poison should first be thoroughly mixed dry in a tub or other vessel and should then be gradually moistened with

water and again thoroughly mixed so that all of the bran is damp. The quantity of water that should be used depends upon the character of the bran. The writer has sometimes used 9 gallons of water to 50 pounds of bran, but half of this amount or less may be sufficient. The bran should not be so wet that it does not crumble readily after being squeezed in the hand, for a sticky bait is much harder to distribute than one of the proper consistency.

The hands are the best instruments for doing the mixing, although a paddle may be used for this purpose. There is little danger of poisoning in mixing a few hundred pounds of bait, if care is taken to avoid breathing the poisoned dust and if the hands and arms are frequently washed with a portion of the water used to moisten the bran.

FIG. 11.—Cutworm killed by a disease

APPLICATION OF THE BAIT AND QUANTITY PER ACRE

In moderate infestations of cutworms an application of the poisoned bait at the rate of 3 pounds (dry weight) per 1,000 plants at the hill is sufficient. In heavier infestations the bait should be broadcast at the rate of 15 or 20 pounds (dry weight) per acre. It is best to distribute the bait several days before the plants are set, or at latest on the same day, and it is desirable that this application should be made late in the evening, so that the bait may be fresh and moist when cutworms become active. In making the application at the hill, the bait should not be thrown upon the plants or against the stems, since some burning may result. The bait will continue to be effective after a light shower has fallen upon it; but heavy rains within a day or two may make it necessary to apply the bait again, for the best results.

TREATMENT OF PLANT BEDS

In case cutworms are found to be causing damage in plant beds, a very satisfactory control may be effected through a broadcast application of the poisoned-bran bait at the rate of 4 pounds (dry weight) to each 100 square yards of plant bed. It is necessary to remove the cloth cover from the bed before applying the bait.

POISONED VEGETATION AS A BAIT

Poisoned vegetation may be used in cutworm control in case clover, alfalfa, dock, or other plants upon which cutworms feed readily are at hand. But the labor cost of control is considerably increased where poisoned vegetation is used in place of the bran bait, especially if the plants must be collected by hand.

This method of control will probably give unsatisfactory results when used for the protection of plants already set in the field, since cutworms will feed upon the tobacco in preference to the poisoned plants. This will certainly be the case if too heavy a dosage of poison has been dusted over the green food. The best results will

be obtained from the use of this material by distributing the poisoned vegetation over the field several days before the tobacco is set, or by scattering it in prepared ditches in case traveling cutworms are to be controlled.

In preparing this bait the plants should be piled on a clean surface, moistened with water, and turned as the poison is dusted over them. This material is then loaded upon a wagon and distributed over the field in small bunches, preferably late in the day, so that the vegetation may be fresh at the time cutworms become active.

FALL PLOWING

Fall plowing is most effective against cutworms when it is done early.

Late fall plowing breaks many of the cells in which some species pass the winter as pupæ, and pupæ in these broken cells die. Without plowing, however, comparatively few cutworm pupæ ordinarily live through the winter, since this stage of the insect is not very resistant to certain weather conditions.

Late fall plowing is not very effective against those species which pass the winter in the larva or cutworm stage. Many of these larvæ are very hardy after they attain some growth. The dingy cutworm, for example, can live a month without any food, and some species thrive on dry vegetation. Fall plowing against such species must be done early, before the eggs are laid or while the larvæ are very small, or it will probably do more harm to the enemies of cutworms present in the field than it will to the cutworms themselves. The time of main flight in several of the more important species is given on preceding pages.

Land plowed in the fall will be infested with cutworms in the spring if an attractive growth of vegetation appears by the time the spring flight of moths begins.

LATE-SPRING PLOWING

Cutworms develop more slowly in plowed fields than they do where an abundant supply of food is available. For this reason they continue to cause damage in fields which were plowed early in the spring for some time after cutworms of the same kinds have become mature and ceased feeding in neighboring unplowed fields.

Late spring plowing thus has an advantage over early spring plowing, from the standpoint of reduction in cutworm injury, since this method tends to bring cutworms to the end of their destructive period at an earlier date than is the case in fields plowed early in the spring. The remaining cutworms are also not confined entirely to the tobacco for food in the late-plowed fields but feed largely upon the plants recently turned under by the plow. The time at which late-spring plowing may be done to the best advantage depends upon the locality.

DITCHING

It sometimes happens that cutworms migrate in large numbers from land in which they have developed and destroy crops in neighboring fields. A combination of ditches and poisoned bait may be used to good advantage against such traveling cutworms.

The ditches employed are of two kinds—the vertical-sided ditch for moist soil and the dusty-sided ditch for dry soil. In the vertical-sided ditch the furrow is thrown away from the field to be protected, and it may be necessary to deepen the furrow by running the plow through a second time, throwing the soil the same way as at first. A coulter is used in order that the edge of the furrow may be as sharp and vertical as possible and this margin may require reshaping with a spade to be most effective.

In the dusty-sided ditch a deep furrow is plowed with the earth thrown toward the field to be protected and a log is ridden up and down this furrow, preferably soon after plowing, until the sides of the furrow are composed of such loose, fine soil that cutworms have great difficulty in climbing out.

Because of the expense involved it is usually not advisable to construct the ditches so that they will in themselves form permanent barriers against traveling cutworms. Their main purpose should be to halt the cutworms temporarily so that they may be induced to feed upon poisoned bait or poisoned vegetation scattered in the ditch. Marching cutworms, unless checked in this way, will sometimes pass over the bait without feeding. In case many cutworms cross the first ditch, it may be necessary to make a second one some distance beyond the other and this should receive an application of poisoned bait when cutworms begin to collect in it.

PRECAUTIONS

The bait and the poisons should not be left where children or livestock can get at them. Paris green alone will be eaten by some animals if they have access to it. When applied at the hill it is possible for stock to obtain enough of the poisoned bait to kill them if they are allowed in the field. In case the vessel used for mixing is to be used for any other purpose, it is advisable that it be thoroughly cleaned before the bait dries, since the latter is removed with difficulty after drying.

SUMMARIZED RECOMMENDATIONS FOR APPLYING POISONED BAIT

A satisfactory poisoned bait for cutworms consists of bran 50 pounds, and Paris green 1 pound, thoroughly mixed dry and then moistened with water. No sweetening or other flavoring is necessary.

Lead arsenate and calcium arsenate are not satisfactory as bait poisons against cutworms.

In moderate infestations of cutworms the bait should be applied at the hill at the rate of 3 pounds (dry weight) per 1,000 plants. In heavy infestations the bait should be broadcast at the rate of 15 or 20 pounds (dry weight) per acre.

In plant beds a broadcast application of 4 pounds (dry weight) of the poisoned bait to each 100 square yards of bed is sufficient.

The application of poisoned bait should be made several days before the plants are set, or at least upon the same day that the plants are set.

It is best to apply the poisoned bait late in the evening, so that it will be fresh and moist when cutworms become active.

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August, 1926

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